Saskatchewan
Environment
and Resource
Management

Solid Waste Management Fact Sheets

MUNICIPAL ENVIRONMENT OFFICES

MUNICIPAL ASSESSMENT AND CERTIFICATION SECTION

The department has eight municipal environment offices to provide service to our municipal clients. They are single-person offices staffed by Municipal Environment Officers (MEOs). The MEOs are normally in the office on Mondays, and sometimes all or part of Fridays. The remainder of the time they are on the road as part of our water, wastewater and solid waste management works inspection program.

The MEO's conduct inspections of municipal water, wastewater and solid waste management facilities. They encourage you to contact them if you have questions about:

- Water, wastewater, or solid waste management problems or complaints;
- Technical operation problems or deficiencies;
- Department regulations or guidelines pertaining to municipal water, wastewater and solid waste management works;
- Drinking water or wastewater quality;
- Monitoring requirements on licenses (Minister's Orders or Permits);
- Quality objectives for drinking water or wastewater (including analysis for bacteria, health/toxicity related chemicals, general chemicals, trihalomethanes and wastewater monitoring).

During office days, or for routine requests, contact:

#1 - Swift Current Office
David Wiegers
2nd Floor, 350 Cheadle St. W.
SWIFT CURRENT SK S9H 4G3
Phone: 778-8496
Fax: 778-8212

#2 - Regina Office
Alvin Yuen
3211 Albert Street
REGINA SK S4S 5W6
Phone: 787-5971
Fax: 787-5623

#3 - Estevan Office
Brent Wilson
2nd Floor, 1219 5th St.
ESTEVAN SK S4A 0Z1
Phone: 637-4604
Fax: 637-4603

#4 - Kindersley Office
Rod Lemon
113 - 2nd Ave. E.
KINDERSLEY SK S0L 1S0
Phone: 463-5460
Fax: 463-5457

#5 - Watrous Office
Gary Papic
403 Main St.
WATROUS SK S0K 4T0
Phone: 946-3233
Fax: 946-2799

#6 - Yorkton Office
David Clark
120 Smith St. E.
YORKTON SK S3N 3V3
Phone: 786-1425
Fax: 786-5716

#7 - North Battleford Office
Don Hilsendager
509 Pioneer Ave.
NORTH BATTLEFORD SK S9A 1E9
Phone: 446-7423
Fax: 446-7464

#8 - Melfort Office
Bob Busch
107 Crawford Ave. E.
MELFORT SK S0E 1A0
Phone: 752-6129
Fax: 752 - 6141

Section Manager - Blaine Ganong
Regina
Phone: 787-6176
Fax: 787-5623

Section Supervisor - Peter Thiele
Regina
Phone: 787-6170
Fax: 787-5623

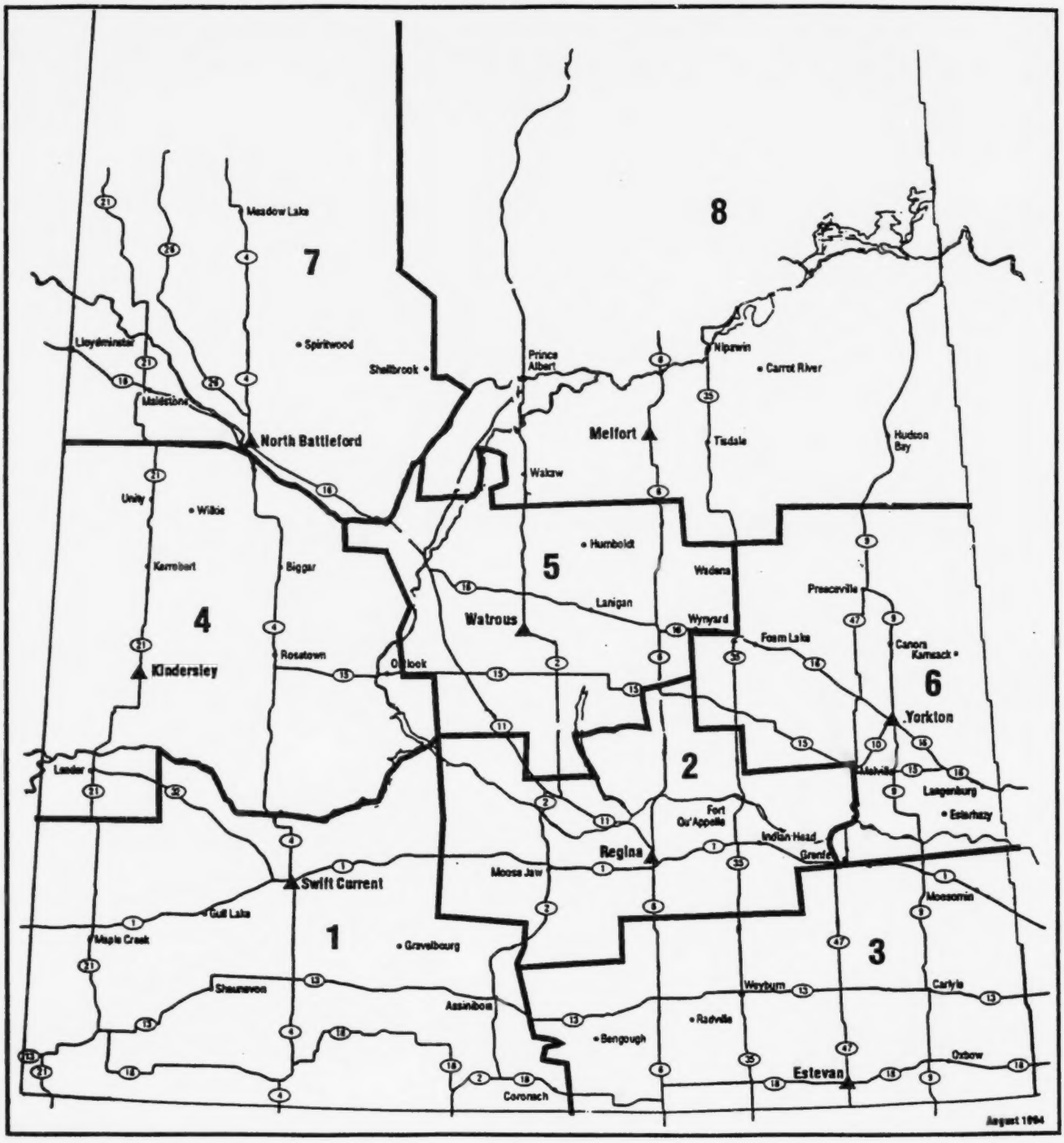
Our **Operator Training Coordinator** invites you to contact him if you have questions about:

- Operator training or workshops;
- Certification for operators;
- Classification of water and wastewater facilities; and
- Clearwater Reporter Newsletter.

Gus Feitzelmayer
Phone: 787-6174
Fax: 787-5623

For emergencies during regular office hours, or when MEOs are unavailable, contact the Regina Office at: 787-6517. For after hours emergencies call: 1-800-667-7525 (Spill Response Centre)

Municipal Environment Offices



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DESIGNATED AREAS AT WASTE DISPOSAL GROUNDS

Today's well planned waste disposal grounds operating as sanitary or modified landfills are divided into several components or "designated areas". Designated areas provide the user and the operator with well defined places in the waste disposal ground to store, treat or dispose of refuse. Designated areas for storage are commonly: metals (whites), tires, and rubble. Compost, petroleum contaminated soils and wood/trees are placed in designated areas for treatment. Designated areas for dead animals, biomedical waste or treated grain are used for disposal. Asbestos can be disposed of in a special designated area which is manifested as a receiver under Transportation of Dangerous Goods legislation. The working face or the garbage disposal area is also considered to be a designated area for the disposal of refuse.

Solid waste is divided into separate categories or "waste streams". The composition of waste streams can vary depending on storage, treatment and disposal methods used or markets available for recycling. The types of waste streams and volumes contained in them are dependent upon the place of generation or "waste shed" such as residential, agricultural, institutional or industrial. Estimated average percentage weights for residential waste steams in Saskatchewan are shown on the following table:

WASTE STREAM	Weight (%)
Paper & Wood	45%
Yard & Food Waste	20%
Glass & Plastics	15%
Metals	15%
Rubber	5%

More accurate percentages by volume can be determined for your community by keeping a daily record of waste received at your waste disposal ground and taking into account any materials which are currently recycled. The most accurate figures can only be determined with the use of a weigh scale.

The life and efficiency of a landfill will increase significantly by separating waste into waste streams and handling them in the appropriate designated areas. Approximately 30 percent of the waste volume is diverted from the working face through recycling of metals, composting of yard waste and handling wood/trees waste in designated areas. Designated areas remove bulky items such as metals from the working face which allows increased compaction rates. Added benefits of decreased rat harbourage, increased trench life and decreased maintenance costs at the working face are derived with the use of designated areas at a waste disposal ground.

The working face is one of the more difficult designated areas to manage. Frequent compaction and cover should be implemented to keep the amount of exposed waste to a minimum. This practise will discourage rats and other vermin, control litter and reduce the amount of fuel if an accidental fire occurs. Always ensure that a stockpile of uncompacted cover material is available near the working face. Weather permitting, the cover material can be placed on the working face.

COMPACTION AND COVERING AT WASTE DISPOSAL GROUNDS

Operate your waste disposal ground using the three following methods to prevent the public from referring to your solid waste management facility as the "Dump" or the "Nuisance Ground":

1. Control access by fencing, locking the gate and **supervising the site** during hours of operation;

2. Separate wastes for storage, treatment or disposal in **designated areas**; and,

3. **Compact and cover** at the designated area known as the working face.

Compaction and covering at the working face achieves several components of operations, maintenance, environmental and legal aspects at waste disposal grounds:

- Litter control
- Rat and vermin control
- Prevention of leachate production
- Extended life of the trench
- Liability prevention
- Odour control
- Fire control
- Public safety
- Aesthetics

Litter Control

The control of litter by compacting and covering at the working face is one of the most important management aspects. While litter does not pose any significant environmental problem, it holds a major place in public perception of site maintenance and impacts on neighbouring land uses. Litter can be one of the prime reasons for the NIMBY (Not in My Back Yard) syndrome when a new waste disposal ground or an expansion is proposed, since prospective neighbours will not want to live near an untidy waste disposal ground.

Garbage compaction and covering on a regular basis while maintaining a minimum sized working face reduces exposure to wind and provides greater control of the waste. This, in turn, reduces the amount of time required by staff to collect wind-blown litter on-site and primarily off-site.

Rat and Vermin Control

Regular compaction and covering of waste at the working face is essential to eliminate access to a food supply and refuge at a waste disposal ground. This practise coupled with maintaining a small working face free of large, bulky items (metals, rubble), ensures a poor food supply for vermin, discourages burrowing

and harbourage by eliminating voids and increases the human activity at the working face which deters vermin.

Fire Control

Decrease the volumes of fuel and the size of the working face with compaction and covering activities. Combustible materials (trees, lumber) in designated areas should be kept well separated to avoid the spread of fires to the working face, tire storage area and others.

Prevention of Leachate Production

Compaction and covering with proper grading will encourage positive drainage away from the landfill cell rather than encouraging infiltration and eventual leachate production. Compaction and covering within a trench at a smaller site with provisions for drainage away from the working face will aid with the operation of the site and minimize leachate production.

Public Safety

Compaction and covering reduces the amount of exposed waste at the working face. This reduces the availability of waste to scavengers who could put themselves at risk when opening bags or rifling through waste. Scavengers are often the cause of excess litter and unnecessary fires at waste disposal grounds. At unsupervised waste disposal grounds where scavengers have free access, compaction and covering on a regular basis will be a large benefit in site operations and maintenance.

Life Extension of the Waste Disposal Ground

Minimum compaction and covering of the waste when the trench is full can DOUBLE the life of the working face. Regular compaction and covering of waste in layers can increase the life of the working face by TEN FOLD depending on machinery used and the thickness of waste layers.

Most small municipalities do not have ready access to machinery, however, if ONLY "soft" garbage is disposed of at the working face, the ramp method can be used for disposal where users of the site effectively compact the refuse as the working face extends outward.

Waste Disposal Ground Aesthetics

Aesthetics and tidiness at the waste disposal ground goes a long way to show users that the site is being managed rather than being a place to dump waste haphazardly. Compaction and cover provides evidence to users that the site is well managed and should be used accordingly.

Odour Control

Compaction and covering reduces odours at the working face primarily during the warmer months. Odour control increases the aesthetics of the site and reduces the chance of attracting vectors such as flies, rats, gulls, skunks and bears.

Liability Prevention

Compaction and cover reduces liability for fires, disruption of agricultural activities off site, and potential off site contamination of groundwater and surface water resources.

Consult with your Municipal Environment Officer to determine the frequency of compaction and covering which best suits your waste disposal ground. The *Cover/Compaction Frequency Determination Guide* shown below provides general recommendations.

COVER/COMPACTION FREQUENCY DETERMINATION GUIDE

Criteria:

The following criteria are used by the Municipal Environment Officers to determine the frequency of compaction and cover of the working face at waste disposal grounds:

- Working Face (size).

- Designated Areas (number, maintenance).

- Supervised Facilities & Locked or Unlocked gates.

- Active Complaints (litter, burning, vermin).

- Type of Operation (trench, mound, ramp).

- Litter Control (fencing, retrieval).

- Isolation Distance (close proximity to residences).

Community Population	Cover/Compaction Frequency Range
<500	2 times/year TO 6 times/year
501 - 1000	2 times/year TO 8 times/year
1001 - 2000	1 time/month TO 2 times/month
2001 - 3000	1 time/month TO 3 times/month
3001 - 5000	1 time/week

It is recognized that cover material may freeze in the winter months making covering of refuse difficult. Communities should make every possible effort to ensure cover material such as uncompacted native material or light, sandy soil is available for winter operations.

LITTER MANAGEMENT AT LANDFILLS

By J. M. Lapp

Litter draws attention to landfills! When litter management is ineffective, a landfill has the appearance of being uncontrolled. In the court of public opinion, perception is reality. Public complaints about litter often lead to other issues. If the problem is not corrected, it results in loss of trust in the landfill operators and raises concerns with the environmental integrity of the site.

Landfill operators will often remark that picking up litter is a never ending job. How many times has a site been cleaned up only to have a strong wind blow the litter again the next day? Picking up litter is a monotonous job that will always be necessary, but there are ways to reduce the amount of wind-blown litter.

HOW DOES LITTER BLOW?

Understanding wind patterns provides clues to control of wind-blown litter. A landfill manager can watch wind patterns and take advantage of them to apply controls. (Fig. 1)

The amount and size of objects carried by the wind is related to the strength and turbulence of the wind. Papers, envelopes, plastic bags, will blow in winds that are less than 30 km/hr. Cardboard boxes will blow in winds under 50 km/hr and when winds are over 80 km/hr, metal cans can be blown.

Turbulent winds are created by soil stockpiles and result in litter being lofted out of disposal trenches. Wind is "compressed" where it passes the apex of hills or stockpiles, or as where it funnels through trench. This compression increases wind speed thereby increasing litter problems.

CONTROLS

Wind-blown litter can be controlled through a five-step program. (Fig. 2)

1. Cover wastes frequently

Covering wastes is essential for litter control as it eliminates exposure of wastes to wind.

2. Shelter the working face

Sheltering a landfill reduces the wind strength and turbulence. Natural windbreaks around the site perimeter, such as trees, can provide shelter Artificial windbreaks

or "wind screens" such as snow fence, can be placed upwind of the active landfill and moved as the landfill development moves.

3. Use catchment fences

Catchment fences are most effective when placed immediately downwind of the active working face. Catchment fences are typically constructed with a two inch mesh to allow the free flow of air and to trap litter.

4. Use perimeter fences.

Perimeter fences provide site security, but also provide a opportunity to catch litter that may escape the active landfill area. A perimeter fence, such as page wire, can be very effective in reducing the amount of litter that escapes to neighbouring land.

5. Pick up the litter that does escape.

The landfill manager must retrieve litter from fences, roadways, open areas, and from neighbouring properties.

PUBLIC TRUST

An effective litter control program does not draw public attention but a poor litter program does! Continued use of a landfill can be dependent on public trust and effective litter controls are one of the essential elements in gaining this trust.

J.M. Lapp, is a senior waste management technologist with Alberta Environmental Protection and principal of J L Technical Services. This article is based on the Publication "Sanitary Landfill - Controlling Wind-blown Litter (AEP, 1983).

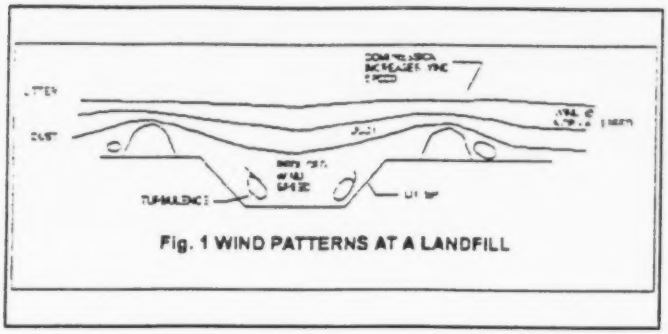

Fig. 1 WIND PATTERNS AT A LANDFILL

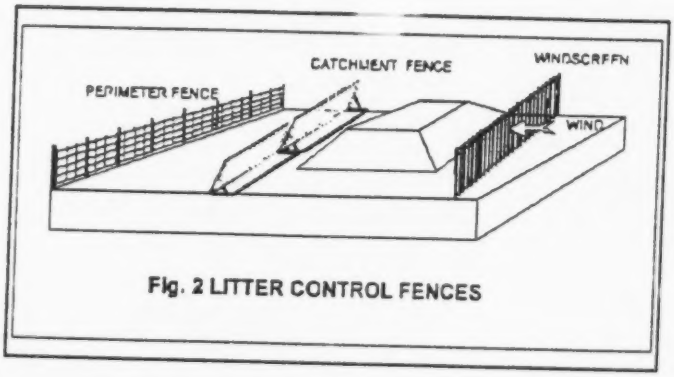

Fig. 2 LITTER CONTROL FENCES

RAT CONTROL AT WASTE DISPOSAL GROUNDS

Background

The effective control of rats at waste disposal grounds is directly influenced by the management and operation of the sites. Rats require adequate food, harbourage and water to sustain populations. Well managed waste disposal grounds minimize the conditions favourable to rat populations.

Waste Disposal Ground Management

Management techniques which form the foundation of cost-sensitive, well maintained waste disposal grounds provide the most effective methods to discourage rat infestations.

1. Minimize the food supply at waste disposal grounds.

Composting at home and/or at the waste disposal ground removes large quantities of food supply available to rats. Organic material such as peelings, garden trimmings, spoiled vegetables and stock pen cleanings can be recovered from the waste stream and food supply by processing it into a useful product through composting.

Immediate burial of spoiled and treated grain, elevator cleanings and dead animals.

Waste tipped at the working face or disposal area of waste disposal grounds should be spread, compacted and covered as frequently as possible. A rule of thumb currently used is to spread, compact and cover waste once per month per 1000 people served. This practise removes access to remaining food supplies and discourages burrowing and harbourage at waste disposal grounds.

2. Prevent opportunities for harbourage at waste disposal grounds.

Designated areas constructed for the treatment, storage and disposal of materials significantly reduce the volumes of wastes which require burial at the working face. They reduce harbourage by preventing the creation of voids during compaction and covering activities. The types of designated areas which assist in reducing harbourage are storage areas for metals (fridges, stoves, etc.), trees and lumber, tires, concrete, rocks and rubble and demolition material.

3. Burn only wood and trees at waste disposal grounds.

Wood and trees burn completely if the burning is conducted under controlled conditions in designated areas at waste disposal grounds.

Garbage in the working face should not be burned. Since garbage has a high moisture content, it does not burn completely. Partially burned garbage continues to provide a source of food for rats.

Burning forces rats into burrows in uncompacted waste during the fire event and creates additional harbourage in burned out containers. They return to feed on unburned waste when conditions are safe.

Results from field inspections of waste disposal grounds in 1994 indicate that burning of all waste increases complaints involving rats. Rat infestation accounted for 14% of complaints at waste disposal grounds where no burning occurred. Thirty percent of complaints were recorded where uncontolled burning was taking place. This information supports the theory that rats tend to be attracted to waste disposal grounds by smoke from burning refuse.

4. Provide positive drainage away from waste disposal grounds.

Water should not be allowed to pond or pool at waste disposal grounds. Without daily requirements for water, rats will be discouraged from residing at waste disposal grounds.

5. Bait waste disposal grounds when necessary.

A baiting program by a local Pest Control Officer may be required to overcome large infestations which have burrowed into a former uncompacted landfill operation. Occasionally, baiting may have to be conducted in the designated areas or at buildings at waste disposal grounds if evidence of rats becomes apparent.

DISPOSAL OF TREES INFECTED WITH DUTCH ELM DISEASE

The Dutch Elm Disease was introduced to North America from Europe in 1930 and first detected in Saskatchewan in 1990. Infected trees have been found in the Souris River, Saskatchewan River, Carrot River, Qu'Appelle River and Wascana Creek Valleys. This year, the infection has been located at additional locations. Infected elms have been removed in Estevan, Weyburn, Regina and Shaunavon.

Spread by the elm bark beetle which breeds under the bark of dead or dying American and Siberian elm trees, the Dutch Elm disease is caused by a fungus which blocks the tree's water conducting system. Elm bark beetles are easily transported to new locations in the bark of elm firewood and in vehicles carrying firewood.

Burning or burying elm wood is presently the most acceptable method of handling dead or infected trees and limbs. Urban and rural municipalities which have permission to burn wood and trees at designated areas in their waste disposal grounds are best equipped to deal with elm wood. Municipalities which do not have access to a waste disposal ground with permission to burn trees and lumber may designate an alternate burn site. Permission to burn at a designated site not located at a waste disposal ground can be acquired from the Air Quality Section of Commercial Branch at 787-6197.

For further information regarding the Dutch Elm Disease, please contact your local conservation officer, extension agrologist or SERM Forestry Branch at 953-2221. The Municipal Branch, Standards and Approvals Section can be reached at 787-6267 for permission to burn trees and lumber at waste disposal grounds.

BURNING AT WASTE DISPOSAL GROUNDS

There has been much controversy regarding burning at landfill sites in Saskatchewan over the last few years. We would like to clarify the existing situation for municipalities.

At present, municipalities are permitted to conduct selective burning at many landfill sites. If your community does not already have written approval from the department for the burning of trees and lumber, you can request approval by writing to:

Saskatchewan Environment
and Resource Management
Municipal Branch
3211 Albert Street
Regina, Saskatchewan
S4S 5W6

Once you have received an approval letter, you do not need to notify the department prior to each burn.

Burning must be done under controlled conditions. Only trees and lumber may be burned.

A separate designated area used exclusively for burning should be set aside. Burning should take place only in the designated area, well away from any other combustible materials such as tires, and well away from the working face (refuse disposal area) of the waste disposal ground.

Common sense should be used when burning. Never burn during windy conditions, and take precautions to ensure that cinders do not escape the burning area. We recommend that whenever possible, fire suppression equipment should be present at the site or on standby. Burns should be supervised until the fire is completely extinguished. Burning during prolonged dry periods or when emergency fire bans are in place should also be avoided.

Don't forget the "good neighbour policy". Be considerate to those living near the waste disposal ground. Don't burn when the wind will carry smoke toward your neighbours. Be especially careful that fire does not escape the waste disposal ground. A fire guard around the landfill is recommended. Remember your community is responsible should a fire escape the site and cause damage to the property of others. Burning at landfills can be an unexpectedly expensive proposition if fire escapes your site.

Try to make arrangements with local area residents before you undertake burning of trees and lumber. Develop an understanding of how and when burning will be

done, the procedures to be used, and precautions to be taken when burning. The community is liable for any damages which occur.

If you require more information, or have questions, please contact your Municipal Environment Officer.

CONSTRUCTION/DEMOLITION MATERIAL

REUSE AND DISPOSAL GUIDELINES

The Construction/Demolition (C&D) Material Waste Stream is defined as bulk refuse originating from construction, demolition, renovation, and re-development projects not including asbestos, waste dangerous goods nor material contaminated with waste dangerous goods.

Construction/demolition material can be separated into several categories which allow for recycling and re-use. Although this activity can be time and labour intensive, material for re-use and recycling is increasing in popularity and value. High disposal costs at waste disposal grounds due to volume and weight reduction can be significantly avoided through material separation.

The following table identifies many of the construction/demolition wastes commonly generated in Saskatchewan and the potential to re-use and recycle separated materials.

C&D Activity	Separated Materials	Possible Re-use/Recycling End Use
Road Reconstruction	Asphalt	Crushed and mixed with new asphalt, fill material, road subbase
	Concrete (without rebar)	Road subbase, re-used in concrete, concrete blocks, fill material, rip-rap on roads and lagoons
	Concrete (with rebar)	Fill material, rip-rap
	Separated rebar, metal signs, sign posts and guardrails, culverts	Re-use for original purpose, Processing at a steel mill
	Fill Materials (earth, gravel, sand)	Clean fill material, landscaping material, landfill cover
Excavation/Levelling	Topsoil	Landscaping, residential fill, landfill cover, agricultural
	Sand	Fill, residential, road construction
	Stones	Rip-rap, fill, landscaping
	Earth contaminated with wood, buried utilities	Fill, possible landfill cover, disposal at landfill
Site Clearance	Trees and Brush	Firewood, chipping for landscaping, composting, landfill disposal
	Soils	Landscaping fill, agricultural fill, residential fill
	Mixed Concrete, Rubble, Sand and Steel	Land reclamation fill, landfill disposal

C&D Activity	Separated Materials	Possible Re-use/Recycling End Use
Building C&D Material - Reusable	Clean Bricks, Whole Cindercrete Blocks, Concrete or Stone Facades, Tiles, Ceramics, concrete roofing tiles	Resale for re-use for original purpose; Resale for landscaping; Use for permanent roadway construction in landfills
	Undamaged Windows and Doors	Resale for re-use
	Undamaged metal siding or roofing	
	Undamaged vinal siding	
	Wooden Cabinets, Counters, Flooring, Staircases, and Trim	
	Plumbing and Electrical Fittings	
	Carpeting	
	Clean insulation	
	Wooden Beams and Facades	
Building C&D Material - Recyclable	Broken Bricks, Cindercrete Blocks, concrete roof tiles, Concrete and Stone Facades, Tiles, Ceramics	Resale for landscaping Crushed Clean fill for road subbase, roadways, and rip-rap; Use for stabilization of roadbases or fill at landfills Clean fill for land reclamation
	Broken window glass, glass fixtures	Recycling at Glass Recycler (Canosphere) Recycling for glasphalt mix Recycling for use with rubber crumb (Magnum Industries)
	Broken wooden beams, trim, wood scrap, trees	Chipping or shredding for landscaping, composting, fuel source
	Metal girders, supports, rebar, damaged metal siding, roofing	Recycling at a steel mill (Ipsco)
	Scrap Aluminum door and window frames	Sale to scrap dealer; recycling at an aluminum smelter
Building C&D Material - Disposal	Mixed waste not suitable for separation and materials which cannot be re-used or recycled. No waste dangerous goods	Disposal at an approved waste disposal ground.
	Asphalt Shingles, & linoleum flooring	
	Waste Dangerous Goods including asbestos	Manifesting under Dangerous Goods Transportation Legislation. Treatment or disposal at approved sites using approved methods only.

Note: Material types, quantities and end use of materials will vary depending on the location of the project, season of the year that the project takes place and the cause of the need for demolition (i.e. age, urban renewal, fire, tornado, or flood).

References: CONSTRUCTION WASTE & DEMOLITION DEBRIS RECYCLING... A PRIMER SWANA Publication # GR-REC 300, 1993

CONSTRUCTION AND DEMOLITION WASTE IN CANADA, Senes Consultants Ltd., Environment Canada, December, 1993

Saskatchewan
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Guidelines

for Treatment and Disposal of Petroleum Contaminated Soils at Municipal Waste Disposal Grounds

December 1995

Foreword

These guidelines provide information on the land surface **treatment** option for petroleum contaminated soils and on the **disposal** of petroleum contaminated soils at municipal waste disposal grounds. The Commercial Branch of Saskatchewan Environment and Resource Management (SERM) should be contacted to obtain requirements for treatment at commercial soil treatment facilities or on private property.

A **municipality** wishing to accept petroleum contaminated soils at their waste disposal ground can use these guidelines to indicate the permitting requirements under *The Municipal Refuse Management Regulations*. These guidelines will also provide municipalities with a better understanding of the soil management steps needed to achieve full and satisfactory treatment of petroleum contaminated soils once accepted at their landfill.

Municipalities should be careful not to unduly restrict the regular operation of the waste disposal ground due to the land area and time required to treat petroleum contaminated soils. Heavier petroleum hydrocarbons such as engine oils require a longer treatment period than lighter hydrocarbons such as gasoline.

1.0 Introduction

Soil contamination commonly occurs when petroleum storage and handling systems leak and fuel spills contaminate surrounding soils, or when repeated overfills, surface spillage and housekeeping losses result in a contaminated area. When this occurs, the soil acts as an on-going source of contamination which may need to be remediated to prevent it from continuing to be a source of pollution.

These guidelines provide direction on the treatment of soils contaminated with **refined petroleum hydrocarbons**. For the purposes of this document, refined petroleum hydrocarbons includes any mixture of hydrocarbons that is or could be used as a combustible fuel and includes gasoline, diesel fuel, aviation fuel, kerosene, naphtha, fuel oil and heating fuel, and lubricating oils such as new and used engine oil.

One of the most practical ways for treating petroleum contaminated soils is by some form of land surface treatment whereby petroleum contaminated soils are applied onto the soil surface and periodically turned over or tilled to aerate the contaminated soils to enhance the volatilization and biodegradation processes. To facilitate prompt remediation of the soils they must be spread thinly and disced or rototilled regularly.

Tilling the soils promotes volatilization (evaporation) of the lighter portions while the remaining compounds are immobilized within the soil mass and breakdown biologically. Naturally occurring soil micro-organisms such as bacteria and fungi combine with sunlight, oxygen and moisture to biodegrade (breakdown biologically) the petroleum products.

Soils which have been successfully remediated are acceptable for reuse, either as intermediate or final cover at municipal waste disposal sites.

2.0 Why Use Land Surface Treatment

Properly done, land surface treatment or soil venting will quickly and reliably destroy petroleum contaminants with negligible impact on ground or surface waters, the soils, human health or the environment.

In most instances, the breakdown of the petroleum residues is complete within one growing season, however this is very dependant upon the nature and concentration of the original petroleum materials as well as a number of other environmental factors. Venting of petroleum contaminated soil represents a cost-effective means of remediating soils with residual amounts of petroleum hydrocarbon contamination. This technique is not appropriate when there is free (liquid) petroleum product.

The following information is intended for municipalities wishing to accept petroleum contaminated soils for surface land treatment at municipal waste disposal grounds.

A municipal waste disposal ground is not required to obtain a permit or prior approval for receiving these materials.

Saskatchewan Environment and Resource Management requires that petroleum contaminated soil be treated prior to reuse or disposal. Landspreading of petroleum contaminated soils is effective in reducing the level of contaminants in the soil through the processes of volatilization (evaporation of the volatile compounds), biodegradation of the residual materials and, to a lesser extent, immobilization of some compounds.

3.0 Permission Requirements

Municipalities wishing to accept petroleum contaminated soils at their waste disposal ground may do so without permission from the department unless it is specifically prohibited by a Permit or Minister's Order.

Individuals must obtain permission from the owner to use a municipal waste disposal ground for treatment and disposal of petroleum contaminated soil.

4.0 Land Application Procedures

Recommended procedures for land surface treatment at municipal waste disposal facilities are outlined below.

- Contaminated soils should be applied when the land is tillable, generally no earlier than April 1 and no later than November 1, weather permitting. At times outside of these periods, the soils may be stockpiled if adequate and acceptable precautions are taken to prevent leaching of contamination from the petroleum contaminated soils into the underlying soils and runoff is contained on site.
- The greater the petroleum loading rate (the initial soil volumes and contaminant concentrations) the more time and effort the treatment of the soils will require. Contaminated soils should not be applied in thicknesses greater than can be completely turned over with one pass of the tilling equipment being used.
- Soil application rates for specific spreading thicknesses are as follows:
  - 1500 m^3/hectare (800 yd^3/acre) at 15 cm (6") spreading thickness
  - 1000 m^3/hectare (530 yd^3/acre) at 10 cm (4") spreading thickness
  - 500 m^3/hectare (265 yd^3/acre) at 5 cm (2") spreading thickness
- The area required for surface land treatment based on a spreading thickness of 15 cm (6") may also be approximated as follows:
  Acre(s) Required = Volume of Soil (yd^3 X 0.00125)
  Hectares Required = Volume of Soil (m^3 X 0.000667)
- The land application site should be marked with stakes and/or flags. The stakes should remain in place during treatment of the contaminated soil and until the remediated soil is removed.

- Soils should be tilled as soon as practical (within 48 hours) after application. Fertilizers or organic materials, if used, may be added either before or after soil spreading.
- To enhance hydrocarbon breakdown, the soil treatment layer should be thoroughly aerated (disced or tilled) approximately once every two weeks or as required to optimize hydrocarbon breakdown and satisfy the oxygen demand of the soil microorganisms. Frequent tilling may cause excessive volatilization, excessive drying and create dust problems, and should be avoided. Infrequent tilling may not provide adequate aeration and mixing particularly on heavy-textured soils and may slow hydrocarbon breakdown. Aeration is to continue until hydrocarbon concentrations decrease to acceptable levels.
- Odours generated from the treatment site will be greatest during initial spreading of the petroleum contaminated soils and initial tilling operations. Odour generation is highly temperature dependant. The odours generated from tilling may be mitigated by scheduling these activities during cooler weather or cooler times of the day such as morning or early evening. Tilling during windy conditions providing the treatment layer is moist enough to prevent or minimize dust may dissipate odours more efficiently and avoiding impacts on adjacent properties. Tilling should be avoided during inversions or calm periods.

5.0 Monitoring Requirements

Soil sampling to document the initial level of contaminants in the soils is recommended. Monitoring of the soils is also required to confirm completion of treatment for the contaminated soils.

If the soils are to be used as cover material at a municipal waste disposal facility, sampling and laboratory analyses of the treated soils is not required (but is recommended periodically as a check on the adequacy of the treatment methods used). At a minimum, if the soils have received one full treatment season (three consecutive months between May and September) and produce vapour readings of less than five per cent LEL (Lower explosive limit) using an explosion meter, the soils may be used for cover materials at the landfill.

The treatment site should be inspected periodically by the operator to ensure that the area is neither too wet (no water is ponding on the site) nor too dry.

Pre-screening of the contaminated soil layer using soil vapour concentration measurements will often provide an indication of the degree of contamination remaining in the soils. Once the vapour measurement results have been reduced to acceptable levels (less than five per cent LEL) or there is no significant hydrocarbon odour remaining in the soils, the soil is acceptable for cover material. Laboratory analysis can be used to confirm that treatment is complete.